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Consideration of technical regulations to be listed in the Compendium of Candidates for UN GTRs, if any:

Request to insert in the Compendium of Candidate for UN GTR, European Union Regulations No. 2017/1151 and 2017/1154 on Real Driving Emissions (RDE)

Submitted by the representative of the European Union*

The document reproduced below is submitted by the European Union to the Executive Committee (AC.3) for consideration. It is a request to include in the Compendium of Candidates the Real Driving Emissions methodology. The document is based on informal document WP.29–174–09. In order to be considered by AC.3, this request is accompanied by a copy of the regulations mentioned (see Article 5, paras. 5.2.1., 5.2.1.1. and 5.2.2. of the 1998 Agreement).

* In accordance with the programme of work of the Inland Transport Committee for 2018–2019 (ECE/TRANS/274, para. 123 and ECE/TRANS/2018/21/Add.1, Cluster 3), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

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Request to insert in the Compendium of Candidate for UN GTR, European Union Regulations No. 2017/1151 and 2017/1154 on Real Driving Emissions (RDE)

1. The European Union requests to include in the Compendium of Candidates the European Real Driving Emissions (RDE) Methodology, as this is currently developed in European RDE acts 1, 2 and 3.

I. Background

2. The European technical working group on RDE-LDV has been working continuously since 2011 in order to develop a procedure capable to assess the emissions from light duty vehicles during real world driving, the so-called Real Driving Emissions (RDE) procedure. Automotive industry, instrument manufacturers, technical experts, environmental NGOs and European legislators participated to the work of the group.

3. The methodology was implemented in European legislation in three steps between 2015 and 2017 (RDE1, RDE2 and RDE3). RDE1 set the main elements of the methodology, RDE2 set the related Not-To Exceed (NTE) limits for NOx measurements and RDE3 introduced cold start and the measurement of Particle Numbers.

4. The consolidated text describing the methodology as it stands in Europe can be found in the Annex IIIa of the Regulation (EU) 2017/1151, in the following link: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02017R1151-20170727.

II. Real Driving Emissions development

5. In Europe the mandatory NOx emission limits for diesel cars have been progressively lowered from 500 mg/km at Euro 3 to 80 mg/km at Euro 6. However, there was strong evidence available already in 2011 that despite these increasingly stringent NOx limits, that were verified under laboratory conditions and on the standardised test cycle (NEDC), the actual NOx emissions under real-world conditions remained high (Weiss et al. 2011). Euro 5/6 legislation (EU 2007/715) nevertheless requires the regulatory emission limits to be met under "normal conditions of use" and not to a specific test cycle.

6. In response to this, the Commission has developed the RDE procedure. This new test procedure makes use of a Portable Emission Measurement System (PEMS) in order to measure emissions while the car drives on a real road. Methodologies were also developed to ensure that the vehicle is driven in a normal way without biased driving that would result in higher emissions than encountered in normal conditions of use and for evaluating the results.

7. The RDE procedure is vital to controlling the real driving emissions of NOx from diesel cars and of Particles from both diesel and GDI cars. It was phased in for monitoring purposes in Europe from early 2016 to complement the laboratory testing. For the procedure to be effective, mandatory not-to exceed limits were introduced in Europe with a staged introduction, starting in September 2017 for new types of vehicles.

CF per Stage	*Mass of oxides of nitrogen (NO_x)*	*Number of particles (PN)*
1st stage	2,1	1 + *margin* PN with *margin* PN = 0,5
2nd stage	1 + *margin* with *margin* = 0,5	1 + *margin* PN with *margin* PN = 0,5

Note: *margin* and *margin* PN are subject to annual review

III. Costs and Benefits

8. The new methodology will result in substantial benefits to the public health and welfare through significant annual reductions in emissions of NOx and PN. The clean air impact of this programme will be significant when fully implemented. Given that NOx emissions from diesel cars contribute significantly to Europe's air quality problems, especially in the so-called urban hotspots, any measure that would bring real driving emissions closer to the prescribed limits would have substantial health and environmental benefits.

9. A study prepared for the European Commission's air quality review by IIASA in 2013 analysed the impacts of different assumptions on Euro 6 real world emissions from diesel cars, forming the basis for the assessment of benefits. This study showed that the level of the overall NOx emissions up to 2030 depends "strongly on the effectiveness of Euro 6 emission controls under real-world driving conditions."

10. The study's baseline scenario assumes that real-driving NOx emissions from Euro 6 light duty diesel vehicles will decrease in two steps, namely to about 310 mg NOx/km in a first step from 2015 and to 120 mg NOx/km in a second step from 2017/18. The second reduction was assumed to result from the introduction of RDE testing together with not-to-exceed limits. Compared to the Euro 6 fail scenario, where NOx continue at the level of 310 mg/km after 2017/2018, the benefits would be substantial.

11. The savings between the Euro 6 fail scenario and the baseline scenario is roughly 500 kilotons (kt) in 2020 and 600 kt in 2030. By contrast, the Euro 6 impact assessment from 2006 only assumed that a reduction of 282 kt of NOx would result from the introduction of the Euro 5 and 6 limits in 2020, by comparison to Euro 4. Relying on the findings of the IIASA study, this means that the benefits of an RDE test would exceed the benefits that were assumed to come from the introduction of the Euro 5 and Euro 6 standards in terms of NOx emissions from diesel cars.

12. A simple order of magnitude calculation that applies the standard damage cost value for NOx[1] from CE Delft (2008) to every tonne of NOx above the baseline can provide an indication of the potential benefits. With an average annual gap of 550 kt of NOx between the two scenarios during the ten-year period from the beginning of 2020 to the beginning of 2030, these benefits would reach € 23.5 billion[2].

[1] The study quotes € 4400 per tonne of NOx for the EU 25 in 2000 prices (p.54). This value was updated to the years in question by applying a 2% rate.

[2] Net present value in 2017 at a 4% discount rate

IV. Conclusion of the Cost / Benefit analysis

13. The Cost assumptions of Euro 5/6 impact assessment are still valid and potentially even on the high side. With a wider deployment of advanced emission control systems (especially SCR systems), the cost is expected to fall further, increasing the gap between impact assessment estimates and actual cost.

14. Avoided NOx emissions are in the order of magnitude of 500-600 kt per year – more than assumed in the Euro 5/6 impact assessment. Monetised benefits are very substantial - roughly € 23.5 billion over the ten-year period starting in 2020

V. General comments on the Conclusion of the Cost / Benefit analysis

15. The cost of introducing an RDE methodology and the related NTE limits depends widely on the state of development of the after-treatment systems already in use in the various markets. This is defined by various factors, such as the stringency of the limits and the enforcement powers of the surveillance and conformity checking programmes in the various regions. It is therefore hard to estimate the cost of introduction of RDE requirements for other regions.

16. In Europe it was estimated that a two-step approach was needed to put the diesel fleet on a clear compliance trajectory while minimising the disruption to development and product cycles. Overall, car makers that have bigger deviations between emissions in the lab and real driving emissions will be more affected than the ones who have already made the effort to install after-treatment equipment that allow compliance in real driving conditions.

VI. Regulatory Text

17. Consolidated version of RDE1 and RDE2 in Annex IIIA of WLTP: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R1151

18. The text for RDE3 can be found at:
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32017R1154

19. While the consolidated version of all three acts can be found in Annex IIIA of the following:
http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02017R1151-20170727